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THE ANCYLATHERAN CALAMAGROSTIS OF EASTERN NORTH AMERICA

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(Plates 836 and 837)

The discovery at Mount Commis, in the Quebec Appalachian Range, some eight miles behind Rimouski City, of a new Calamagrostis belonging to a difficult group¹ necessitated the re-examination of the related species. *Calamagrostis Lepageana*, n. sp., pertains to Clarion's genus *Deyeuxia*² having the sterile rachilla prolonged on the side of its solitary flower³ and a geniculate awn twisted below and longer than the glumes. For the species with long or short geniculate and twisted awn, so highly developed in western South America, in the mountains of Mexico and in the Cordilleran Range of North America, Ascherson & Graebner⁴ have proposed the subsection *Ancylatherae*. The species of the other subsection (*Orthoatherae*), on the contrary, with straight awn and the lemma much longer ($\frac{1}{4}$ to $\frac{1}{3}$) than the palea, centering around the most aggressive and variable *Calamagrostis canadensis*, are copiously represented in eastern North America, while the former group, there very restricted geographically and specifically, takes the recessive attitude of

¹ Stebbins, Jr., G. L.—A Revision of some North American species of Calamagrostis. RHODORA 32: 35-59, plate 195, 1930.

² Palisot de Beauvois.—1812. Essai d'une nouvelle Agrostologie, 43.

³ The species of *Deyeuxia* with 2-3-flowered spikelets have been transferred to *Trisetum*, in the subgenus *Isoelytrum* Ls-Marie. Cf. The Genus *Trisetum* in America by the author, in RHODORA 30: 209-23, 237-45 (1928).

⁴ Ascherson & Graebner.—Synopsis der Mittel-Europäischen Flora. II, part 1, pp. 197-223.

endemic species of the pre-Wisconsin dispersal with disrupted ranges.

Up to date, only four species have been recognized in eastern North America, as pertaining to the Deyeuxian type, with arista geniculate and twisted: *Calamagrostis Porteri* A. Gray, *C. perplexa* Scribn., *C. purpurascens* R. Br. and *C. Pickeringii* A. Gray. Professor Fernald has been interested for a long time in the last species and in its var. *debilis* (Kearney) Fern. & Wiegand.¹ He writes in RHODORA: "Dominant on peaty barrens at all levels in Newfoundland and Nova Scotia, it is absent from New Brunswick and most of Maine, but reappears in the alpine areas of Mt. Katahdin, the White Mts., the northern Green Mts. and the Adirondacks, whence it occasionally descends to the valleys The range of the species is, emphatically, a disrupted one. The nearest allies of *C. Pickeringii*, are *C. Porteri* Gray and *C. perplexa* Scribn. *C. Porteri* is one of the rarest of relic-species, with four isolated stations: one each, on rocky wooded slopes, in Chemung Co., New York; Huntington Co., Pennsylvania; and Page and Giles Cos., western Virginia. *C. perplexa* is even rarer: with the original station a bluff in Tompkins Co., New York, the other (for a similar but not quite identical plant) a quartzite cliff in Piscataquis Co., Maine.

"Also having a geniculate and exserted awn is the arctic *Calamagrostis purpurascens* R. Br., likewise with a remarkably disrupted range: the unglaciated margin of Greenland; arctic northwestern Canada, thence along the Cordillera to South Dakota, Colorado, Nevada and California; with the only known station in the East (south of Greenland), a single colony on one of the highest cliffs of Bic, Quebec."²

Thanks to the courtesy of the Director of the Gray Herbarium, the types of *C. Porteri* and *C. perplexa*, and the specimens from the other localities mentioned in the above quotation have been sent to me for study and comparison. The material from the type locality for each species seems to be quite unique, and the other collections referred to it, that I have seen,³ are not very

¹ Fernald, M. L. & K. M. Wiegand.—*Calamagrostis Pickeringii*, var. *debilis*, RHODORA 15: 135-136 (1913).

² Fernald, M. L.—Recent Discoveries in the Newfoundland Flora. RHODORA 35: 212-213. 1933.

³ Hitchcock's Manual of Grasses of N. Amer. (1935) cites three localities: New Hampshire, White Mts.; Ontario (Lake Nipigon), Canada; Minnesota (Fond du Lac).

good matches, as the following short analysis should amply prove.

C. PORTERI A. Gray, Proc. Amer. Acad. **6**: 79. Huntingdon County, Pa., *Porter*, Aug. 12, 1862 (TYPE at the Gray Herbarium).

Prof. Thomas C. Porter, botanizing in Huntingdon Co., Pennsylvania, met for the first time his *Calamagrostis*, on August the 11th, and snatched up an incomplete specimen; this was on Warrior Ridge, at the spot called "Pulpit Rocks". The next day, and probably in the same place, he collected two complete plants which later on were taken as the type; on the label there is an important documentation: "*Calamagrostis Porteri*, n. sp. *Calamagrostis confinis*, Nutt.?¹ Near Alexandria, Huntingdon Co., Penn. Aug. 12, 1862 leg. T. C. Porter". On a second label, also in Porter's writing, we read: "*Calamagrostis confinis* Nutt.? The hairs at the base of the paleae are shorter than given in the description of the species and the leaves have a tuft of pubescence beneath the ligule. I found it not in a swamp, but in a dry wood on the side of a steep hill." This note, apparently cut from a letter to Asa Gray, written after the publication of *C. Porteri*, in a moment of not very good humour, beside adding a precious detail on the habitat, stresses two strategic characters, which since then have figured in the Floras, holding the aa and bb of the keys: the tuft of pubescence at the summit of the sheath and the abundance or shortness of the callus hairs.

Professor Porter returned to "Pulpit Rocks, Warrior Ridge" in August, 1864, and found an extremely large specimen of his species, with a strong culm, 2 mm. thick at summit, the inflorescence perfectly erect, interrupted and 22 cm. long. He returned to Huntingdon Co. eighteen years later, and recollected his *Calamagrostis* abundantly, on August 18, 1882.

The Gray Herbarium has two sheets of this collection. One is labelled by the collector: "near Barree, Huntingdon Co., Pa., in woods on hillsides." The specimen is nice and complete with very broad leaves, up to 9 mm. wide, and enough rhizome to show why the plant cannot grow in tussocks. As in *C. perplexa*,

This collection (Wood's in 1899), the type of *C. breviseta*, var. *lacustris* Kearney, belongs to the *C. Pickeringii* group.

¹ *C. confinis* Nutt. (*Arundo confinis* Willd.), still described in the 6th. edition of the Gray's Manual (1890), is now placed in *C. inexpansa*, Gray. Beal retained it as *C. neglecta*, var. *confinis*.

the young shoots develop sympodially at the extremity of the horizontal section of the rhizome where no lateral branches are found. The second sheet, which came from the herbarium of Walter Deane through Charles Edward Faxon, carries a long and rather weak specimen. It is labeled: *Deyeuxia Porteri* (Gray) Vasey. Wooded hillside on Juniata R. [river], below Barree, Huntingdon Co., Pa." Now, this last bit of geography is useful. The Juniata River passes Alexandria and Barree through the Warrior Ridge. The station below Barree and that at Pulpit Rocks are both in the Warrior Ridge and near Alexandria, in woods on hillsides; they must be very near together, if not the same.

The five sheets of Porter's collections form a lot morphologically homogeneous. Typically, then, the species is a tall (1-1.30 m.) grass having blades 5-9 mm. broad and ligule 5-8 mm. long; the panicle, 11-22 cm. long, is generally interrupted below and long-exserted (14-28 cm.); the somewhat chartaceous glumes differ in length by 0.5 mm.; the lemma and palea are subequal, differing only by 0.2 mm., the awn (3 mm. long) is shorter than the glumes, as in *C. perplexa*, and protrudes only at the side of the spikelet; the hairs, nearly absent on the front of the callus, are few, but sometimes quite long, on its sides; the anthers are 2-3 mm. long and the young caryopsis red.

The other collections from Virginia and New York State do not all match the type. The nearest seems to be *Steele & Steele* no. 103, from Stony Man Mt., alt. 3600 ft., in the Blue Ridge, near Luray, Page Co., Virginia, Aug. 11, 1901. The plant is weaker than the type in all its characters: culm 69-74.4 cm. high, with blades 4-5 mm. broad; panicle 8.4-13 cm. long; the first glume about 1 mm. longer than the second; lemma 3.6 mm. long, palea 3 mm. long: these two last figures do not fit the definition of *C. Porteri*. The other number from Page Co. is a recent collection of July, 1935, from Mt. Marshall, alt. 900 m., in the Blue Ridge, *H. A. Allard*, no. 754. It is a tuft of nine flowering stems and of a few sterile shoots, sharing apparently the same much branched rootstock; the culm is wiry and very thin, less than 1 mm. in diameter under the panicle which is 7-10 cm. long, and bears three narrow (2-3 mm. broad), almost erect, dark green leaves. This plant seems to be out of place in the cover of

C. Porteri, and was put there only temporarily. In Giles Co., Virginia, on Bald Knob, alt. 4448 ft., Aug., 1901, H. L. Clark found, and poorly collected, a *Calamagrostis* having the "specific geniculate twisted awn and the foliar tuft of pubescence". But how can we reduce to the umbrophilous pale green *C. Porteri*, confined to wooded slopes and hillsides, this specimen, "de grande lumière", with purplish-bronzed spikelets and growing on a "Bald Knob", at 4448 ft. altitude? Its leaf-blades are 12 cm. long and 4 mm. broad; its panicle goes down to 4.4 cm. long, its spikelet to 3.5 mm. and the lemma to 2.6 mm. long. The plant of New York State is from Sullivan Hill, upper waters of the Susquehanna River, Chemung Co., and was collected by *T. F. Lucy* (no. 11850), July 27, 1895. It resembles Porter's plants in general habit and gross morphology but is strangely different in its spikelet, which has very heteromorph glumes, the lower being 4–4.2 mm. long and the upper only 3–3.5 mm. long; the floret, on the contrary, has a palea as long as the lemma, and often a little longer. These two last and significant characters belong neither to *C. Porteri* nor to *C. perplexa*.

The few collections found in the largest American herbaria under the cover of *C. Porteri*, beside the topotypes, are so different from the type that even a keen botanist could not get through them a true conception of the species. This may have been the case in the publication of *C. insperata* Swallen,¹ collected in Jackson Co., Ohio, less than 300 miles from the type locality of *C. Porteri*, by F. Bartley and L. L. Pontius. Judging by the original diagnosis and by a few spikelets of *C. insperata*, sent to me by Mrs. Agnes Chase, this last species matches *C. Porteri* quite perfectly: culms 85–110 cm. high; longest blade 30 cm. long and 8 mm. wide; panicles 12–14 cm. long; glumes unequal, the longer 5 to 5.5 mm. long; in the few spikelets dissected by me the 1st glume was 5 mm. long and the 2nd 4.2 mm. The awn is strongly twisted and the pattern of callus-hairs thus described by the author "moderately dense, the lateral ones about half as long as the lemma"; anthers about 2 mm. long. All these im-

¹ Journ. Wash. Acad. Sci. 25: no. 9, 413–414. Sept. 15, 1935. TYPE in the U. S. National Herbarium no. 1,611,713. Collected in Ofer (Ophir) Hollow, Liberty Township, Jackson Co., Ohio, Aug. 1, 1934, by *Floyd Bartley* and *Leslie L. Pontius*. A second collection from the same locality bears the data, "Top of dry cliff in Ophir Hollow."

portant characteristics are as if taken from the description already given of *C. Porteri* and indicate not much relation to *C. Pickeringii*, as first believed. This collection from Ohio shows us in what directions the limits of the geographical distribution of *C. Porteri* should be sought.

C. PERPLEXA Scribn., U. S. Dept. Agr., Div. Agrost. Circ. **30**: 7. 1901. Based on *C. nemoralis* Kearney, 1898, not *C. nemoralis* Phil., 1896. Ithaca, N. Y., *Dudley* in 1864.

A brief description of the typical material of *C. perplexa* is necessary to the firm establishment of *C. Lepageana*. The *Dudley* type was collected at Danby,¹ Tompkins Co., N. Y., Aug. 5, 1884. On the label, we read the following ecological note: "High hill. West Danby . . . in dry woods of Rock Oaks, Hickories, with *Ceanothus*, *Vacc. stamineum*, etc. Culms scattered. Two tufts of hairs at base of blade of leaf, thus appr. *C. Porteri* Gr. Panicle pale, branches appressed." On a secondary label, W. J. Beal has written: "*C. Porteri*, florets rather small"; on the sheet, in Kearney's hand there is "*C. nemoralis* n. sp. (T. H. K. jr.)" and in Fernald's "*C. perplexa* Scribn." K. M. Wiegand and R. N. Jones recollected this very rare species in 1917 at Danby, which is near Cornell University; the label gives "dry woods, Thatcher's Pinnacle", no. 7544.²

The Danby plant is smaller in all its parts than typical *C. Porteri*, in spite of the misleading description in Hitchcock's *Manual of Grasses* (1935): "Resembling *C. Porteri*, differing in the somewhat larger, denser panicle." Its scattered culms are 65–104 cm. high, with a panicle 10 cm. long but shortly exerted (4–12 cm.); the spikelet ranges from 3.3 to 4.4 mm. long; the prolongation of the rachilla is much shorter (0.4 mm. long) and thinner than in *C. Porteri* and *C. Lepageana*; the hair on the callus is longer and more abundant than in Porter's grass.

C. Fernaldii, n. sp. A *Calamagrosti perplexa* differt in partibus suis vegetativis, quae quadam affinitate cum *C. Pickeringii* gaudent. Planta caespitosa vel subcaespitosa, 20–88 cm. alta;

¹ For more detailed notes on *C. perplexa* from Danby, see *Dudley's Cayuga Flora* (1886); Rept. N. Y. State Mus. **41**: 58, 1888; U. S. Dept. Agr. Bull. **11**: 26, 1898 and Circ. **30**: 7, 1901.

² W. R. Dudley, on the label of his type collection (1884), had a manuscript name which, two years later, in his *Flora*, he dropped for *C. Porteri*. In 1898, Kearney published his new species *C. nemoralis*, not noticing that Philippi, in 1896, had used *C. nemoralis* for a South American species. Lamson-Scribner, in U. S. Dept. Agr. Circular **30**: 7, 1901, replaced it by the very appropriate *C. perplexa*.

foliis culmi tribus, longis et erectis; *panicula* 6–9 cm. longa. A *Calamagrosti Pickeringii* differt aliunde in *spiculis*, quae contrario similes his *C. perplexae* apparent, cum *glumis* 3–3.7 mm. longis; *lemmate* 3 mm. longo, aristato prope (0.5 mm.) basin, arista 2 mm. longa, in medio geniculata et mediocriter torta; *palea* 2.5 mm. longa; *pilis calli* numerosis, 2–2.5 mm. longis; pilis rachillae paleam aequantibus. MAINE, Piscataquis Co., Boarstone Mt., alt. 1800 ft., Elliottsville, Aug. 16, 1895, *M. L. Fernald*, no. 427 (TYPE in the Gray Herbarium).

The type collection was found in the Gray Herbarium under *C. perplexa*. It is *M. L. Fernald*, no. 427 from Maine. The label was printed *Calamagrostis Porteri* Gray, and on one of the two sheets of this number present in the Gray Herbarium, there is "fide Scribner"; on the sheet, Kearney has written "*C. nemoralis* n. sp." The plant is certainly baffling. Following Kearney's identification, Fernald puts this collection in *C. perplexa*, but always admitting it as not identical. Scribner had assimilated it with *C. Porteri*, undoubtedly as a "pis aller", and before the publication of *C. nemoralis* Kearney. About this plant Wiegand and Eames took a very different position. In their Flora of the Cayuga Lake Basin, they wrote, under *C. perplexa*: "Dry rocky woods, on subneutral sandstone residual soils; very rare. July–Aug. N.w crest and slope of Thatcher Pinnacles, Danby (D. !). Reported elsewhere only from Piscataquis Co., Maine, but an inspection of that plant shows it to be not the same, and more like an offshoot of *C. Pickeringii*. The Danby plant is related to *C. Porteri*."¹ In general habit the Piscataquis County plant looks like *C. Pickeringii*, var. *debilis*, but inside its spikelets there is the abundance of hairs that characterizes *C. perplexa*. Nevertheless, it cannot be united to the Danby type, which has "scattered culms" and "two tufts of hairs at the base of the leaf"; it is cespitose and has no tufts of hairs at the summit of its sheaths.

In Hitchcock's Manual of Grasses (1935), three other stations are mentioned under *C. perplexa*, the author having merged in that species the not-often-spoken-of var. *lacustris* of *C. Pickeringii*—Minnesota, Fond du Lac, *F. F. Wood*, 1889 (TYPE of var. *lacustris*); Ontario, Lake Nipigon (both mentioned by Kearney in his revision of American *Calamagrostis*, with others around the

¹ Wiegand, K. M. & A. J. Eames, Flora of the Cayuga Lake Basin. Memoir 92: 75. Cornell University, Ithaca, N. Y., 1925.

Great Lakes)¹. The last locality indicated by Hitchcock was the White Mountains, New Hampshire. In response to one of my letters to Washington on these extra-typical collections of *C. perplexa*, J. R. Swallen, associate botanist at the U. S. Dept. of Agriculture, sent me a few spikelets of a Mt. Washington specimen, apparently the basis of Hitchcock's citation, with a description and a drawing of the plant. Later on, through the courtesy of Dr. W. R. Maxon, I received the plant itself with a manuscript note of Mrs. Agnes Chase identifying the collector's handwriting. It was impossible to see the type of *Calamagrostis breviseta lacustris* Kearney, which is in hiding for the duration of the war. Luckily we have from the Gray Herbarium good collections of *C. Pickeringii*, var. *lacustris*, from the region of the Great Lakes and elsewhere, one (Isle Royale, Mich., Porter 1865) cited as typical by Kearney in his original publication which permits clearing up this case also.

The plant of Mount Washington (Lake of the Clouds, New Hampshire, collected by *William Boott*, Sept. 8, 1862) remained for a long time without specific name. On the herbarium sheet I find a label in pencil in the lower left corner on which W. Boott wrote the locality and the date of his collection; a second one, "Ex Herb. Gray", is in Dr. B. L. Robinson's script; a third, "Ex Herb. William Boott", bears in F. T. Hubbard's script *Calamagrostis Pickeringii* Gray; on the sheet A. S. Hitchcock added *C. perplexa* in pencil.

This extraordinary plant of William Boott from Mt. Washington being undoubtedly specifically distinct from all that I had studied before, an eloquent diagnosis in latin was rapidly written down and a new item *Calamagrostis nubila*, "from the clouds", inserted in my key. This addition was sent with great relief to Prof. Fernald, editor of RHODORA, who immediately poured a bit of cold water on my enthusiasm, by pointing out that the type collection of *C. Pickeringii* was equally from Mount Washington and probably from the alpine Lake of the Clouds itself. At first, I must confess, I did not like this news! He advised me, and very wisely, to complete the revision of this small group of *Calamagrostis* with twisted and geniculate awns, by studying all

¹ Kearney, Thomas H., Jr.—A revision of the North American species of *Calamagrostis*. U. S. Dept. Agr. Bull. 11: 7-42. 1898.

the material present in the Gray and the New England Botanical Club Herbaria of the *C. Pickeringii* complex, type and varieties. And so I did, with great satisfaction finally.

After going attentively over 152 collections of *C. Pickeringii*, or thus identified (that is, some 460 inflorescences and the rest), after noting down many observations on the variability of the vegetative characters of this polymorphous species (Fernald and Wiegand in a note on *C. Pickeringii*, var. *debilis*¹ made a similar remark), especially of the underground stock, of its rhizomal or tufting habits, I am more than ever convinced that it is possible to segregate the specific entities here involved only by taking into account the general habit and by distinguishing between long or short, abundant or scant callus-hair. The disposition of the hairs on the callus—what we may call *their pattern*, a highly constant feature,—seems most satisfactory and should be taken as the primordial character, since it assures us of a better understanding of the group.

The length of the callus-hairs, as everybody knows, is an outstanding trait in the subsection *Orthoatherae* of the genus *Calamagrostis* and so it is among the Ancylatheran species now under consideration. But in this last difficult group, as we just wrote, the clarification of the different specific types cannot be done safely if we do not go further and study the easily separable patterns of pilosity characterizing the extra-floral callus. The quality of the rachillar hairs may be studied later on, if necessary. If we compare the eastern North American species of *Calamagrostis* with geniculate twisted awns, we can readily segregate and distribute them into a continuous series, running from *C. Pickeringii* through *C. lacustris*, *C. Porteri* and *C. perplexa*, *C. purpurascens* and *C. Lepageana*, n. sp., to *C. nubila*, n. sp., of Mt. Washington (PLATE 836, FIGS. 1-4).

The first species, *C. Pickeringii* (FIG. 1), has no hairs on the front of the callus (under the median nerve of the lemma) and only two rudimentary tufts on the sides, occasionally turned in the direction of the rachilla, of very short hairs, 1 mm. long or less, perfectly drawn in Hitchcock's Manual, p. 314, fig. 627.

In a second pattern (FIG. 2) the lateral tufts of hairs are long and strong, reaching $\frac{2}{3}$ to $\frac{3}{4}$ of the lemma, still leaving a gap

¹ Fernald, M. L. & K. M. Wiegand, RHODORA 15: 135-136, 1913.

between them on the frontal callus where there is no hair, as in typical *C. lacustris*, as met on the lowlands of the Great Lakes region and in Newfoundland. The hairless gap is still well marked in *C. Porteri*, the long hairs of the lateral tufts being few. In *C. perplexa*, on the contrary, the frontal gap is much reduced by the spreading of the strong lateral tufts; the same disposition is met ordinarily in the alpine collections classified up to date under *C. Pickeringii*, var. *lacustris* or var. *debilis*, and under *C. perplexa*; Fernald no. 425 belongs to this type (FIG. 2).

In a third pattern of callus-pilosity, the two lateral tufts are present: short in *C. purpurascens*, long in *C. Lepageana*, but uniting the two tufts there is a string of shorter hairs running across the frontal callus (FIG. 3); here again the affinity of these two last species seems apparent.

At the other end of the series, in a fourth pattern, stands quite alone *C. nubila*, having no lateral tufts but a veil of long (3–4 mm.) hairs evenly distributed all around the lemma, the longer reaching the tip of the floret (FIG. 4).

These four patterns of callus-hair should suffice for the time being to solve our immediate problems. Later on, with abundant and representative material, especially in what we call to-day *C. Porteri*, *C. lacustris*, *C. perplexa* and *C. nubila*, other patterns of pilosity may fall in line and demand recognition. Experimental taxonomy would find a marvelous field for testing critical species in the genus *Calamagrostis*, especially in the subsection of western and eastern entities with geniculate twisted awn.

C. PICKERINGII A. Gray, Man. ed. 2, 547. 1856. White Mountains, N. H., *Pickering* (TYPE in the Gray Herbarium). *C. sylvatica* var. *brevisetata* A. Gray, Man. 582, 1848. *Deyeuxia Pickeringii* Vasey, Grasses U. S. 28, 1883. *C. breviseta* Scribn. Mem. Torr. Bot. Club 5: 41. 1894.

So I come back to the type of *C. Pickeringii*, collected in Sept., 1842, in the White Mountains and originally named on the label *C. sylvatica*; it is a coarse plant, the spikelets examined ranging from 3.8 mm. long to 4.2 mm. On the same herbarium sheet is a second collection from Herb. Oakes with a printed label: *Calamagrostis sylvatica*, L. Var. *brevisetata*, Gray, Manual, ed. 1. Alpine Regions, White Mountains, New Hampshire.

Asa Gray has written on it "*C. Pickeringii*, Gray." The first collection, that mentioned in the Manual, is the type. *C. sylvatica* is a very different European species, much nearer to the western American *C. rubescens*, to *C. purpurascens* and to *C. Lepageana* than to the present species, which has very little callus-hair. The alpine regions of Mount Washington have been visited by several botanists who have collected *Calamagrostis* on their way up or at the Lake of the Clouds. Edwin and Charles E. Faxon seem to have specialized on this high mountain and on *C. Pickeringii*. On Sept. 1, 1877, in Oakes Gulf, they collected typical material and var. *debilis*. On Sept. 2, 1877, at Grand Gulf, they collected a plant very hard to classify if we do not look at the callus-hair pattern; on its three labels are written *C. stricta*, *C. neglecta* and *C. Pickeringii*, var. *debilis*. On August 28, 1882, the Faxons are back in Oakes Gulf; on Sept. 4, 1885, they are at the Lake of the Clouds; on August 29, 1890, at the "Head of Oakes Gulf". At the same time, maybe in the company of the Faxons, C. G. Pringle went up "the wet slopes of the White Mts., Aug. 29, 1877", and probably to the Grand Gulf of Mt. Washington on Sept. 2, 1877, where he collected the same critical plant found by the Faxons on the same day! On its label, I find the same uneasy determination three times different: *C. stricta*, *C. Pickeringii* and in pencil "too old,—perhaps referable to *C. neglecta*". The spikelets are in full fruit surrounded by long silky hairs, easier to see since half of the glumes have been disarticulated or torn off by dissecting needles. This shedding of the glumes and the prudent "too old, perhaps" is a sufficient proof of the unorthodoxy of this mutant.

Several other botanists climbed also to Lake of the Clouds, Geo. G. Kennedy (1891), B. L. Robinson (1901), W. W. Eggleston (1901), A. S. Hitchcock (1917), Paul Standley and E. P. Killip (1921), etc., but they collected only *C. Pickeringii*, more or less typical. In some of the Faxon collections (Sept. 1877, 1882 and 1885) from Mt. Washington, the last one exactly from Lake of the Clouds, the lateral tufts of hairs are not so stiff and so reduced as in the type and are more spreading along the lateral nerves of the lemma.

After a careful study of the principal collections made on Mt. Washington, at Lake of the Clouds and nearby, one thing is

absolutely clear, I think: the type of *C. Pickeringii*, with two rudimentary tufts of callus-hairs, and the plant (*W. Boott*, Sept. 8, 1862), chosen as the type of the new species *C. nubila*, with its long hairs evenly distributed on its callus, are two extremes which strikingly differ from all the other species between them. This last species, here described, is phylogenetically important, making the bridge, with its well geniculate twisted awn and its diffuse velum of covering hairs, between the subsections *Orthoatherae* and *Ancylatherae* of the genus *Calamagrostis*.

Kearney in his revision of *Calamagrostis* mentioned few abnormalities; but these are always of genetical interest. Before putting aside the abundant material of *C. Pickeringii* sent to me, we may note the occurrence of a rachilla having hairs only towards the tip, somewhat as in *C. cinnoides*. In one case, the rachilla was transformed into a normal awn; in another, the caryopsis was transformed by smut into a spur. Finally, a viviparous specimen:

C. PICKERINGII, forma **vivipara**, n. forma. Spiculis viviparis. Having viviparous spikelets. NOVA SCOTIA: Digby Co., wet savannahs along Little River east of Tiddville, Aug. 22, 1920, *Fernald & Long*, no. 19924 (TYPE in the Gray Herbarium).

CALAMAGROSTIS nubila, n. sp. (TAB. 836 et FIG. 4) Species caespitosa, culmis erectis et validis, 55 cm. longis; *lamina* folii 12–18 cm. longa, 5 mm. lata et, sicut pars exserta culmi et ramorum inflorescentiae, scabra; vagina folii ad os nullo modo pilifera; *panicula* 13 cm. longa, dense florifera, ramulis longioribus et inferioribus flexuosis, 5 cm. longis; *spiculis* valde uniformibus, puberulentibus; gluma I 5.2 mm. longa in nervo medio perscabra, gluma II 5 mm. longa, trinervata; lemmate membranaceo, 4.2 mm. longo, distincte nervato in apice acuminato dentatoque; *palea* 3 mm. longa, hyalina, angusta et ad apicem emarginata; *antheris* 2 mm. longis et 0.3 mm. latis; *arista* 3 mm. longa, lemma subaequante, geniculata et mediocriter torta; *pilis calli* 3–4 mm. longis et numerosis, nascentibus aequali modo circum totam lemmatis basim eamque perfecte velantibus; *pilis rachillae* 2 mm. longis tantum.—Cespitose species, with erect culms 55 cm. high; leaves firm and scabrous, with blades 12–18 cm. long and 5 mm. wide, the ligule 5 mm. long; the summit of the sheath without a tuft of hairs; panicle 13 cm. long, densely flowered, with long spreading flexuous branches, the lower ones 5 cm. long; spikelets remarkably uniform, puberulent, with glumes 5.2 and 5 mm. long, perscabrous on the median nerve; *lemma*, 4.2 mm. long,

membranaceous and distinctly nerved, at the apex acuminate and dentate; *palea* 3 mm. long, hyaline and narrow, emarginate at the tip; anthers 2 mm. long and 0.3 mm. broad; the awn 3 mm. long, equalling the lemma or nearly so, geniculate and weakly twisted; hairs on the callus 3–4 mm. long, very numerous, may be a hundred, and evenly distributed all around the lemma, veiling it to the summit, the hair on the rachilla shorter and 2 mm. long.—NEW HAMPSHIRE: Mount Washington, Lake of the Clouds, *William Boott*, Sept. 8, 1862 (TYPE in U. S. National Herbarium, no. 907166).

With the same general pattern of callus-pilosity—long hairs all around the lemma without distinct lateral tufts—the following collections, perhaps deserving at least a varietal rank, may be placed here until more material is available for study: NEW HAMPSHIRE, Mt. Washington, Grand Gulf, *E. Faxon*, Sept. 2, 1877, and at the same station and the same date *C. G. Pringle*. The four plants of these two sheets, probably collected together, are somewhat starved; culms weak, 30–40 cm. high, with panicles 5–6 cm. long, the spikelets 3.5 to 4 mm. long, their lemma and palea subequal, well surrounded by long stiff hairs, these less numerous than in typical *C. nubila*. The base of the culm is also strongly geniculate here and apparently not in the William Boott plant. Another collection of Edwin Faxon, from Mount Willard, New Hampshire, July, 1875, labeled *C. hyperborea*, *C. stricta* and *C. Pickeringii*, var. *debilis*, has also long hairs on the front and sides of the callus. In some spikelets the hairs seem to form a continuous velum but in some others they seem to represent three tufts: two lateral and one frontal! Kearney, after having cited this collection among the plants he classed in his *C. breviseta*, var. *lacustris*, was forced to admit that it was a bad match with the specimens from Fond du Lac, Minnesota, and from Isle Royale, Michigan. In fact, it cannot go with *C. breviseta* because its *setae* are long; it cannot go with *C. Porteri* or *C. perplexa* because it has well developed hairs on the front of the callus. This Mt. Willard plant is a good match for the Pease collections (nos. 11695, 11696) from Mt. Crawford, New Hampshire, labeled *C. neglecta* by the collector and *C. Pickeringii*, var. *debilis* by G. L. Stebbins. They do not belong to the subsection *Ancylatherae* and are much nearer *C. inexpansa* than anything else. A last number I find in the Gray Herbarium material of *C. Pickeringii* is a very interesting plant with abundant long

white hairs on its callus, found by *Bayard Long and D. H. Linder* on "wet sphagnous swale at border of Beaver Lake, Yarmouth Co., Nova Scotia, July 25, 1920" (no. 19918). In F. T. Hubbard's delicate script we read on the sheet: "Note long callus-hairs". We may note at the same time that the culm is strictly erect, branching from the first, second and fourth nodes from the ground, the three superior nodes bearing three leaves like the sterile shoots; that the awn is perfectly straight and that the very short (2 mm. long) truncate ligule is of a sort found only, with the rest, in *C. neglecta*, that border species of the subsection *Orthoatherae!*

C. LACUSTRIS (Kearney) Nash, in Britt. and Brown, *Illust. Fl.* ed. 2. 1: 208. 1913. Based on *C. breviseta*, var. *lacustris* Kearney (1898). Fond du Lac, Minn., Wood, 1889 (TYPE in the U. S. Nat. Herbarium). *C. Pickeringii*, var. *lacustris* Hitchc. (1906).

In the specimens of *C. Pickeringii* received there is still another lot with lateral tufts of long callus-hairs, the material of the var. *lacustris*, which Hitchcock in his *Manual of Grasses* has simply transferred, with *Fernald* no. 427, to *C. perplexa*. Thomas H. Kearney in his description of "*C. breviseta lacustris*, var. n. *C. lapponica* A. Gray, *Proc. Am. Acad.*, 6: 78 (1862) in part", writes: "Sometime stoloniferous; rootstock stouter; culms usually taller (5 to 10 dm. high); . . . palea noticeably shorter than the flowering glume . . . : callus hairs more copious, the longer three-fourths to six-sevenths as long as the flowering glume . . . Type specimen in the United States National Herbarium collected at Fond du Lac, Minn., by F. F. Wood, July 23, 1889." Among the "specimens examined," there is a Thos. C. Porter collection from Isle Royale, Michigan, Aug. 2, 1865, which I have here and on the sheet of which Kearney has written *C. breviseta lacustris* n. var. (T. H. K. Jr.). Gray had originally identified this specimen as *Calamagrostis*: "*Lapponica* L. *Manual, Addend.*, 1868". On a second label, Porter, sticking, as on the label of the type of *C. Porteri*, to a favorite though dubious identification, wrote "*Calamagrostis confinis*, Nutt.—? Perhaps it is a variety of *C. stricta*." This collection is as defined by Kearney in his diagnosis and is very different from the types of the two species growing on Mt. Washington. Kearney added "The specimens from the region of the Great Lakes are mostly

very distinct, . . . [from] typical *C. breviseta*. Were it not for the occurrence of a few intergrading forms [Mt. Willard plant of *E. Faxon* is one of them] they would be regarded as representing a perfectly distinct species . . . ¹ Since then, several other representative collections have been made at low altitudes: in New Hampshire, Grafton Co., gravelly bank, North Woodstock, valley of the Pemigewasset River, *M. L. Fernald* no. 11542; in the same County at Arethusa Fall, Livermore, *A. S. Pease*, no. 29041, not so typical. NEWFOUNDLAND, along Harry's River, between Bay St. George and Bay of Islands, "Open boggy areas in woods", *M. L. Fernald & K. M. Wiegand*, no. 2545.

UNGAVA; Lac Mistassini, Aug. 10–17, 1943. *Dutilly & Lepage*, no. 11552A, with tufts of long hairs and a distinct gap between; Northern Tesekau Lake, on Marten River, affluent of Rupert River, lat. 51° 10' and long. w. 76°?', rocher granitique. Aug. 1, 1943. *Dutilly & Lepage*, no. 11368. In four other numbers collected last year by Father A. Dutilly and Abbé Ernest Lepage, on Marten River, 11344, 11410, 11432 and 11367A, the vegetative characters and the awn are as in *C. lacustris*, but the type of callus pilosity is dubious.

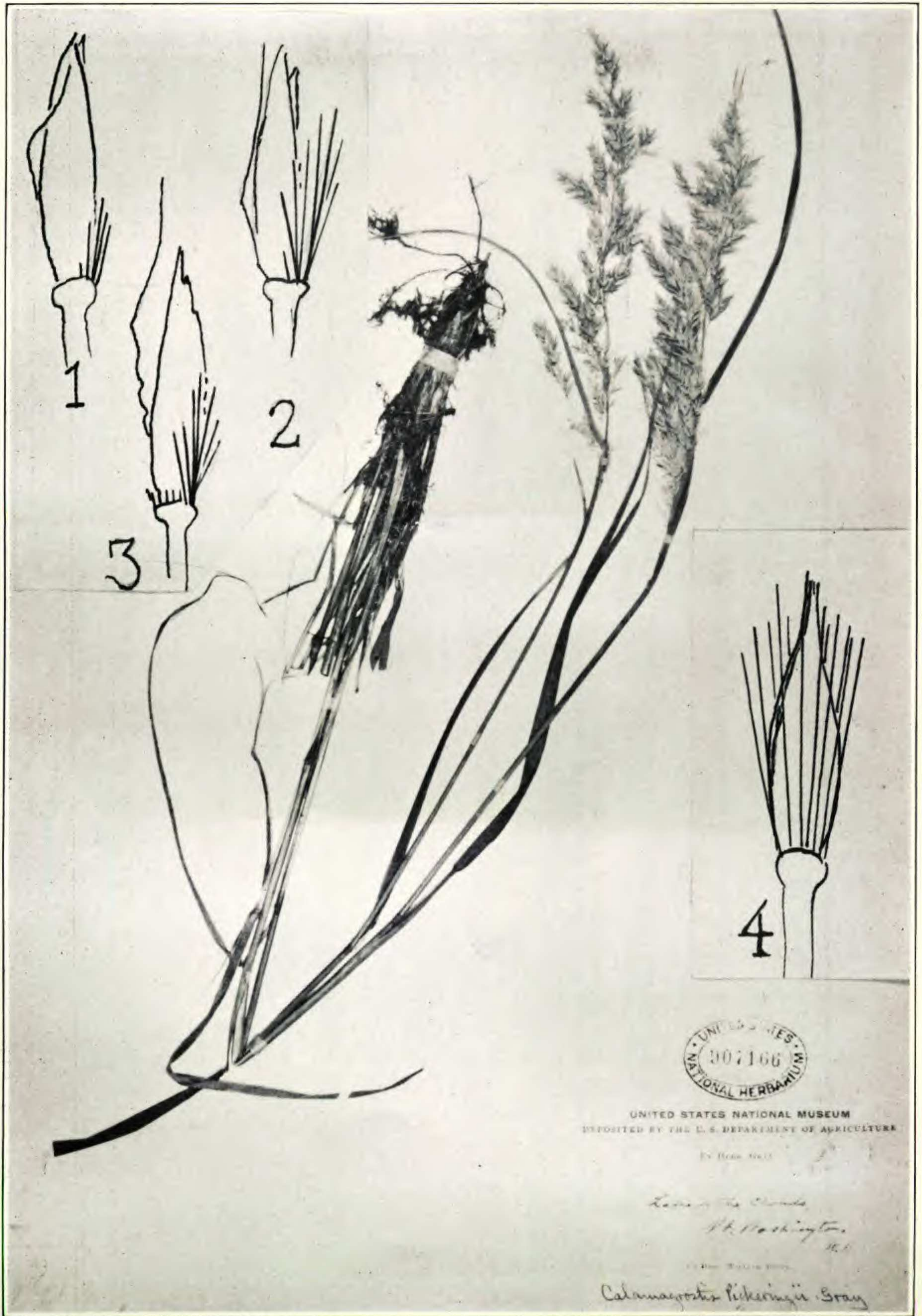
Now let us turn to *C. Lepageana*, from the Rimouski region, Quebec, Canada, which as we have sufficiently proved, differs from the other eastern North American species. Among the western species only one seems to have some affinity with the Mt. Commis plant to be described: it is *C. rubescens*, the geographical distribution of which, as given in the Hitchcock Manual, is "Open pine woods, prairies and banks, Manitoba to British Columbia, south to northern Colorado and central California. A valuable range grass." The type collection of *C. Lepageana* having been made on a "corniche étroite, au pied d'une muraille du Mt. Commis", I asked Father Lepage to climb to the top, covered with a mixed forest of pine and poplars, of this hill, where more of his *Calamagrostis* should be found. He went and collected, on July 6, 1943, some 169 flowering culms which are to be distributed in the *Plantae Exsiccatae Grayanae*, if numerous enough. The plants of this last collection from the summit of Mt. Commis, in a different habitat, dryer and more exposed to wind and sun,

¹ Kearney, Th. H., Jr. U. S. Dept. Agr. Bull. 11: 25–26. 1898.

have a tendency to form little tufts of culms, to have less exerted panicles and to develop on their glumes a purplish pigment. But the Lepage *Calamagrostis* remains still very distinct from *C. rubescens*, which is now a huge mixture including the types of the additional following species: *C. Cusickii* (Oregon), *C. Suksdorfii* (Washington), *C. aleutica angusta* (Santa Cruz, California), *C. subflexuosa* (Oakland, Calif.), *C. fasciculata* (Mendocino Co., Calif.), *C. Suksdorfii luxurians* (Idaho). A. S. Hitchcock ended his list of synonyms by the remark: "This species has been referred by some American authors to *C. sylvatica* DC., and *Deyeuxia varia* Kunth." To complete the course, we may add that *C. Pickeringii* has also been referred to *C. sylvatica*, which in turn is thrown by European botanists into the synonymy of *C. varia*.

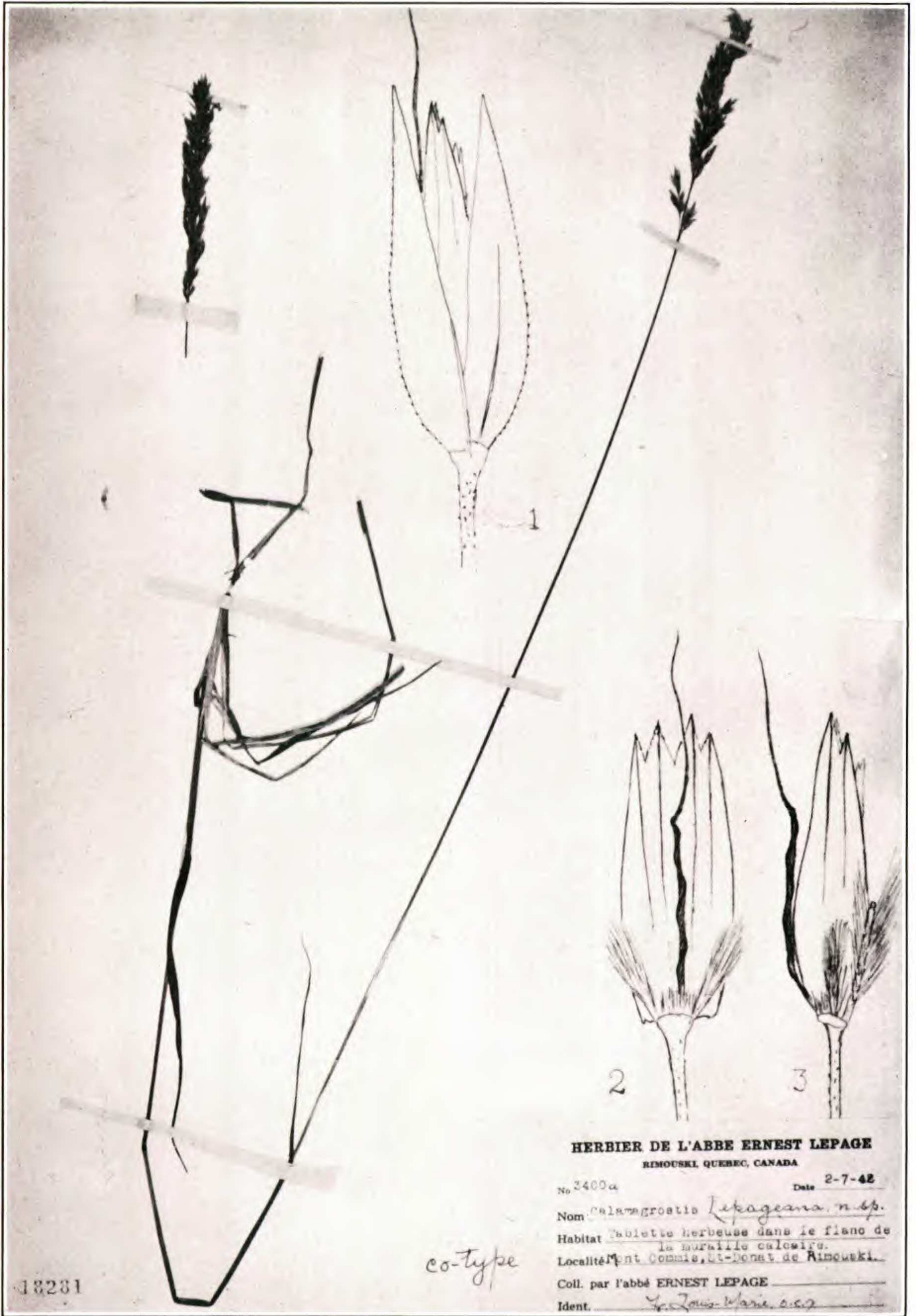
In a preliminary note, addressed to Prof. Fernald last February, I tried to establish the relations existing between *C. Lepageana* and six related species: *C. purpurascens*, *C. rubescens*, *C. Cusickii*, *C. Porteri*, *C. perplexa* and *C. varia*, mainly by comparing their descriptions in different Floras. Under *C. rubescens*, I wrote: ". . . sheath with pubescent collar (as in *C. Porteri* and in *C. perplexa*); awn short, included or protruding at the side of the glumes, not at their tip (in *C. Lepageana*, the awn protrudes at the tip of the spikelet): callus-hairs scant (now we know the importance of the pilosity-pattern); the culms described as tufted, 60 to 100 cm. tall . . ." "*C. Cusickii* Vasey is a large form of *C. rubescens* with lobed inflorescence . . . In Hitchcock, Abrams and Rydberg Floras, I find no other near species . . ." Under *C. varia* Host, "This European species is very variable: one specimen, in our herbarium, from Lugano, San Salvador (Flora der Schweiz) VII, 1910, A. R. Paul leg., has a spikelet nearer to that of the Mt. Commis plant than to any of the American species studied. But other collections of the European *C. varia* (*C. sylvatica*), from Weissenbach, Tirol, *Trepferi*, from Brandenburg, O. Weder, etc., are completely different from the Lepage *Calamagrostis*."

It is impossible to examine the numerous types included in the complex *C. rubescens*, but by the great size of this "valuable range grass", 60-100 cm. high and more, we can infer that its culms have more than two cauline leaves; the specimens I have



Habit: CALAMAGROSTIS NUBILA

FIGS. 1-4, different patterns of callus-pilosity



CALAMAGROSTIS LEPAGEANA

seen of *C. Suksdorfii*, put by Kearney and Hitchcock in *C. rubescens*, were coarse, fleshy and three-leaved. The drawings in Hitchcock's Manual (fig. 618) of a *C. rubescens* spikelet with the equal glumes, with the lemma not strongly dentate and the palea fairly equal, are not like those of *C. Lepageana*.

Nobody could find, even after a thorough study, great affinity between *C. Pickeringii*, growing generally in tufts and including in its purplish spikelets a very short awn with very small hairs, and *Calamagrostis Lepageana*, from Rimouski County, Quebec, named after Father ERNEST LEPAGE who found the plant.¹ The two species, having different geographical ranges, differ also in organization, as the following parallel will show:

	C. PORTERI	C. PERPLEXA	C. LEPAGEANA	C. PICKERINGII (typical)
culm.	89-130 cm.	65-100 cm.	30-65 cm.	30-60 cm. high
habit.	scattered	scattered	scattered	tufting or loosely stoloniferous
cauline leaves. . . .	4	4	2	3
mouth of sheaths.	pubescent	pubescent	glabrous	glabrous
spikelet	4.5-5.5 mm.	3.3-4.4 mm.	4-4.6 mm.	3.8-4.8 mm. long
color.	green	green	mostly green	purplish
panicle	11-22 cm.	9.6-10.5 cm.	6.6-9.2 cm.	6-12 cm. long
exsertion.	long	very short	long	short
lemma.	4-5 mm.	3.2-3.6 mm.	3-4 mm.	2.8-3 mm. long
awn.	3 mm.	2 mm.	5 mm.	2-3 mm. long
hair-pattern.	II (scant)	II (abundant)	III	I
rachilla.	thick	filiform	capitate	thick
caryopsis.	red	red	green	red

As one can see, Porter's, Dudley's and Pickering's Calamagrostis differ greatly morphologically from the Lepage plant, usually 50 cm. high, wiry, its culm being hardly 1 mm. in diameter under the stiff branched panicle. The type collection had scattering rhizomes; but the abundant 1943 material, from the top of Mt. Commis, in different habitat, grew often in little tufts, like *C. Pickeringii* and others. The old sheaths are marcescent and the young shoots have very long (10-20 cm.) and narrow blades, puberulent on their upper face; the leaves of the stem are only two—another character of *C. purpurascens*—one, towards the middle, 7-9 cm. long and only 1-2.5 mm. wide,

¹ The bulk of the type collection, some six sheets, had been sent at first to Washington, where J. R. Swallen recognized immediately the originality of the plant. Just one sheet had been addressed to the University of Montreal and one to the Oka College. Learning that I intended to make a *C. Lepageana* of this plant, Mr. Swallen was good enough to let me have all the material and to work out the problem.

involute at the tip, the other, near the ground, broader but not much longer than the superior one; the ligule, 2 mm. long, is delicate and emarginate. The distribution of the different species, taken in parallel, is geographically on a line going from the Arctic regions to Mt. Commis, to Mt. Washington and the Thatcher Pinnacle, to the more southern Warrior Mts., in the Pennsylvania Blue Ridge. We find *C. Pickeringii* and *C. lacustris* up to Newfoundland, but, so far as I know, they never have been collected in the province of Quebec, at least in the smaller Quebec, excluding the enormous Ungava still lying down like a sphinx before us. Professor Wiegand, a few months before his death, sent me a list of Dr. G. Gardner's collections from Grady Island, Labrador, where I find one number (89) identified as *C. Pickeringii*. This would be the most northern station of this species and the only one in Quebec. But this record must be considered as doubtful; the specimen of Gardner 89 which I received is *C. neglecta*.

To me, the nearest species, morphologically, to the Mt. Commis new type seems to be *C. purpurascens*, which also has two cauline leaves, puberulent on the upper surface; a long awn surpassing the tip of the spikelet and very strong; and, finally, the same dentate-emarginate summit of the lemma with nerves becoming progressively prominent, going up, and the same bidentate hyaline palea. This last and arctic representative of the group with twisted awn had the queer fancy, moreover, to come down and live on the surprising cliffs of Bic, barely ten miles from Rimouski and Mt. Commis. Nevertheless, the following comparison shows that the two species differ sufficiently:

	C. PURPURASCENS	C. LEPAGEANA
spikelet	dark purple	green
length	5-12 mm.	4-4.6 mm.
awn (typical)	6-7.2 mm. long	4-5 mm. long
callus-hairs	III (shorter)	III (longer)
caryopsis	red	olive-green

In the *C. Pickeringii* complex, *C. lacustris*, *C. perplexa* (sensu Hitchcock) and *C. nubila* may look much like the type, in their general habit; the essential difference between them must be sought in their spikelets, in their geographical distribution and their ecological exigencies. Between *C. Lepageana* and *C. pur-*

purascens the main difference which separates them at first sight is their general habit: arctic xerophyte versus temperate mesophyte. The different stations where *C. Lepageana* was found at Mt. Commis are all calcareous.

From the precious notes furnished by Father Ernest Lepage, the habitat may be properly described. The type locality, Mont-Commis, is in St. Donat, Rimouski Co., 8 miles from the St. Lawrence River, in longitude $68^{\circ} 11' 18''$ west, latitude $48^{\circ} 27' 26''$ north, in the Appalache Mt. system, altitude 2600 feet. Mt. Commis by itself is only 500–600 ft. high. The new *Calamagrostis* was found on the north side of this hill, under a perpendicular wall of sandstone and calcareous conglomerates of Silurian age; this fault-escarpment is well marked by the abundant brachyopod *Conchidium Knightii* Sowerby. A mixed forest covers the top of Mt. Commis, but not densely so; in the grass association, rather heliophilous, carpeting this very light forest of the pinus-populus type, *C. Lepageana* grows freely. On the perpendicular wall cling beautifully *Aquilegia canadensis*, *Asplenium viride* and *Woodsia alpina*. Under the escarpment runs a shelf, three feet broad, on which the type of *C. Lepageana* was found in July 2, 1942, with *Botrychium matricariaefolium*, *Carex eburnea* and *C. concinna*, and undoubtedly fallen from above. Bordering the cornice on the talus below, is a formation of *Salix humilis*, *Acer spicatum* and *Cornus rugosa*, underneath which grow *Polystichum Lonchitis*, *Actaea pachypoda*, *A. rubra* and its var. *neglecta*. The lower part of the slope is covered with *Draba arabisans* and the red *Aquilegia*. Stepping into the forest down Mt. Commis, we meet *Polystichum Braunii*, var. *Purshii*, *Athyrium thelypteroides*, etc.

CALAMAGROSTIS **Lepageana**, n. sp. (TAB. 837). Gramen perenne, rhizomatibus (diam. 1.5–2 mm.) satis fragilibus; *culmo* perfecte glabro, 30–65 cm. alto, tenui, diametro vix 1 mm. sub inflorescentia (10–20 cm. longa) exserta; *foliis* annorum praetertorum ut vaginis marcescentibus praesentibus, novis in pagina superiore puberulentibus subtus et in vagina perglabris, caulinis duobus vel aliquando solis, supremo sub panicula 7–9 cm. longum, 2–4 mm. latum; *foliis* innovationum sterilium longioribus (10–20 cm.); *ligula* emarginata, 2 mm. longa; *panicula* ellipsoidea, densa, 6.6–9.2 cm. longa, 0.6–1 cm. lata; *spicula* (e medio paniculae), cum *gluma* I uninervia, 4–4.6 mm. longa, 1.4–1.6 mm. lata, *gluma* II trinervia, 3.5–4.2 mm. longa, 1.2–